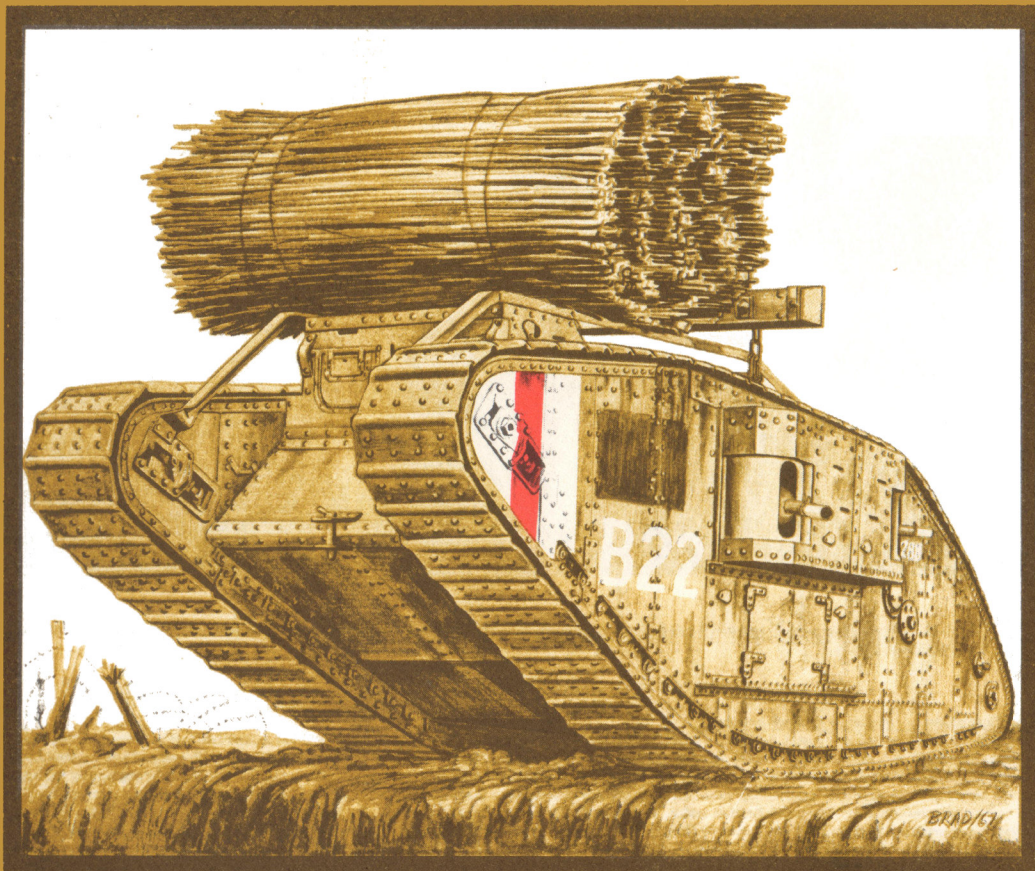




SERIES FOURTEEN

Tank Mark IV	(UK)
Canadian Medium "RAM" Mark II	(CA)
15 CM s FH auf GW III/IV Hummel	(GE)
VK 3001 (P) Porsche Type 100 "LEOPARD"	(GE)



MILITARY VEHICLE PRINTS



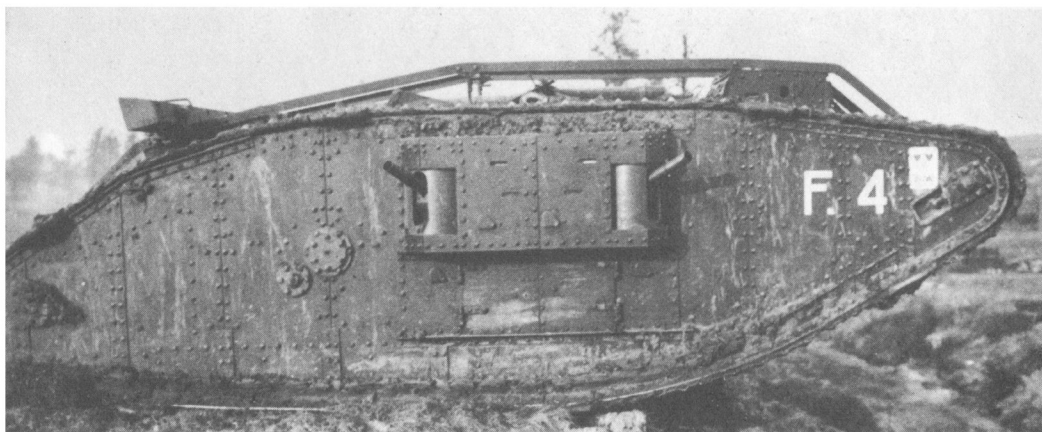
ABOVE A Mark IV Male tank armed with two 6 pdrs and 4 Lewis Machine guns . This is one of the early test vehicles of the Mark IV Series.
(R.A.C. Tank Museum Photo)

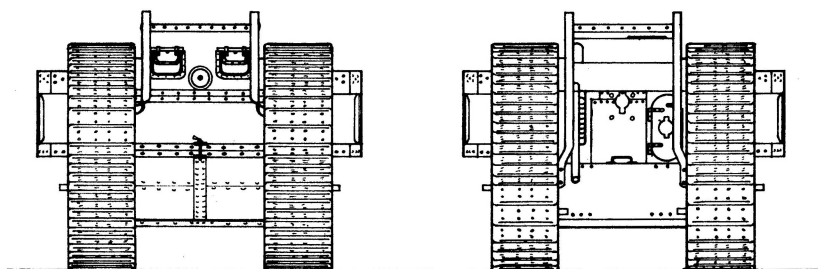
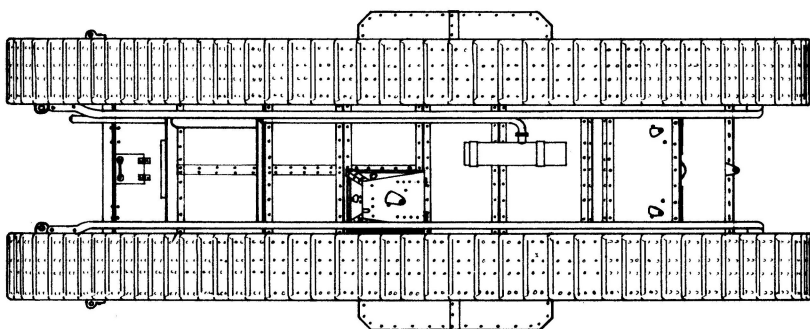
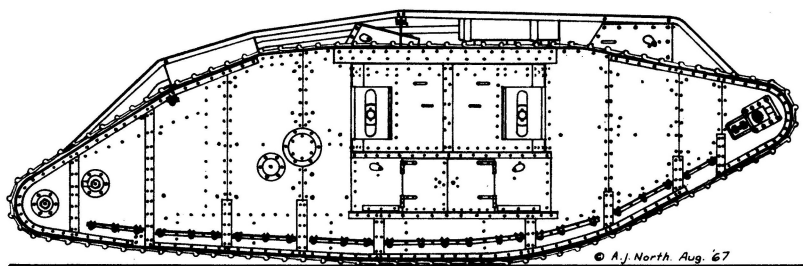
Cover Illustration - Drawn by George Bradford.

The very first tanks which were sent to Service units in 1916 were finished in battleship grey - as befitted a land battleship. However once in France they were repainted in a complicated dazzle pattern of rich brown, green, yellow-ochre and black. The value of such camouflage became doubtful and later a standard finish of Khaki drab was adopted. However, many variations can be seen in photographs - presumably applied by the troops when the tanks were in service. Interesting variation is found with the capture tanks used by the Germans, these were bedecked in vast Iron Crosses so as to be easily recognisable from the British tanks. Some Mark IVs were shipped to the Middle East for operations against the Turks and were used in a few engagements, particularly the Battle of Gaza in 1917. These tanks are believed to have been repainted a camouflage of Sand and Grey. Only a small number were used against the Turks as the maneuverability and reliability was very seriously reduced by the sandy desert conditions.

The majority of the Tank Mark IV Series were produced as Female tanks. The Female tank was armed only with machine guns and therefore was more suited to the role of supporting Infantry in attacks against trenches defended only by the opposing Infantry. The Female Mark IV shown in the cover illustration was destroyed by a mine during the Somme Offensive of September 1918.

BELOW A Mark IV Female tank. Note the smaller sponsons with the double gun position. The rails and beam for unditching can be seen on top.
(Imperial War Museum Photo)





TANK, MARK IV. (Female)

SCALE 1 : 76 (4m.m. to 1 foot) DRAWN BY A.J.D. NORTH.

Tank Mark IV - 1917/18

Historical research by Peter Chamberlain

In September 1916 the World's first tanks - Mark Is (Bellona Prints Series 1 No. 1 UK) - entered service during the British Somme offensive. As would be expected many faults and short comings were discovered in these machines. Once in action new requirements were realised and the necessary recommendations were made to the planning Department. Meanwhile the 150 Mark Is ordered were completed, so while the new model, developed on the battle experience, was being designed it was decided to order a further 50 improved Mark Is - designated Mark II. When further delays occurred 50 more tanks were ordered and these were the Mark III. Production of these expedient models ceased in January 1917. The Mark II and III were externally similar to the Mark I but were without the Tail steering wheels, in addition they featured improved armour distribution and new transmission.

Design of the new model was undertaken by a group under the guidance of a Major Wilson. Official nomenclature allotted was 'Tank Mark IV'. Initial orders were placed at the beginning of 1917 and in the Spring of that year the first vehicles appeared. Production was at the plants of W. Foster and Co. Ltd., Metropolitan Carriage and Wagon Co. Ltd. and several others. The combined output was an impressive total of 1015 Mark IVs. Of these 595 were Female tanks armed only with Machine Guns for anti-infantry work. The remaining 420 were Male Tanks armed with two 6 pdrs. However, a few tanks were modified so as to have a Male sponson on the right hand side and a Female sponson on the left. These vehicles, called "Hermaphrodites" were thus able to engage both Infantry and Tanks.

The first engagement in which Mark IVs took part was on the 17th June, 1917 at Messines. Again in July, in small numbers they were used to assist in the third battle of Ypres and in August at Landemarck-St. Julien. The third Battle of Gaza on November 1st again saw them in action but, of course, the most famous of all was on the 20th November when the massed attack was made in the first Battle of Cambrai. From then on, it was the main tank of the Tank Corps and used in most major battles involving British Forces. The final notable event before the end of the War was the Battle of Selle on October 23rd 1918. In addition to illustrious service with the Tank Corps it became the mainstay of the German Tank Force. Only these sections were equipped with the German A7V the remaining six were equipped with captured British tanks - mainly Mark IVs. The 6pdrs on the Males were replaced by 5.7cm SoKol guns so as to have the same weapons as the German vehicles.

The Mark IV has the honour of being along with the A7V the first tank to engage one another in a tank v tank duel. The story of this engagement is told in the Bellona Print dealing with the German A7V (Bellona Prints Series 10. No. 40 GE).

Besides the very great numbers produced the importance of the Mark IV design was in the improvements over the earlier vehicles. Particularly effective were the efforts to improve crew comfort and protection. A long exhaust carried back to the rear of the vehicle and coupled with an effective silencer considerably reduced the noise level. The engine cooling air was drawn from the interior through a radiator at the rear of the tank and forced out through a louvre, in this was the ventilation was improved. Escape hatches were provided in the roof and those on the sponsons put on the underside plate thus improving protection and allowing larger doors to be used.

So as to take any slackness in the tracks the Idler sprocket was made adjustable. Much trouble had been encountered with tanks becoming bogged down in the muddy conditions and getting stuck in trenches. The first problem was overcome by the fitting of grousers on the track shoes. At first these were made of steel like the track but later they were made from wood. The beam for assisting in unditching the tanks was carried on rails on top of the tank.

When the earlier machines were moved by rail the preparations were extensive. The sponsons had to be removed altogether. But with the Mark IV the sponsons could be folded in to the tank if necessary. The major modification required for this feature was the shortening of the 6pdrs from 40 calibres to 23 calibres. The majority of the series were produced with a 105 HP Daimler sleeve valve engine similar to that of the earlier tanks. But a limited number of the later production vehicles had an improved engine of 125 HP with aluminium pistons and dual carburettors with vacuum feed.

In the post war years extensive tests were carried out with the Mark IVs and they were used as the test bed for several transmission systems, including British Westinghouse Electric, Williams - Janney hydraulic, Hele Shaw Hydraulic, Wilkins Multiple Clutch Gear and Wilson Planetary.

Technical Specification for Tank Mark IV.

Crew: 7
Weight, Combat loaded: 62720 Lbs. 28 long tons, 31.4 short tons 28.5 Tonnes.
Performance
Speed, Max. Road: 3.7 m.p.h. (6Km.p.h.) Cross country: 2 m.p.h. (3.2Km.p.h.)
Trench crossing: 10'-0" (304cm)
Step: 4'-6" (137cm)
Range (Internal fuel) Road: 35 miles (56Km)
Power to weight ratio: (Gross) 3.75HP/ton
Dimensions
Length: 28'-5" (818cm)
Width overall: (Male) 13'-6" (412cm)
Width overall: (Female) 10'-6" (320cm)
Height: 8'-2" (249cm)
Ground clearance: 1'-4" (40.6cm)

Mechanical Details

Engine: 1 x 105HP Daimler Straight 6 cyl. watercooled petrol. Sleeve valve
(Some later model had 125HP engine)

Secondary Armament: (Male) 4 Lewis Machine Guns.

Stowage (Male)

Ammunition, main armament: 184 rds. HE . 20 rds. case shot.

Ammunition, secondary armament: 5640 rds

Stowage (Female)

Ammunition, 12972 rds.

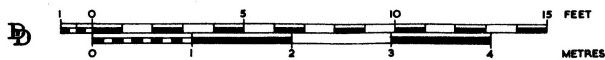
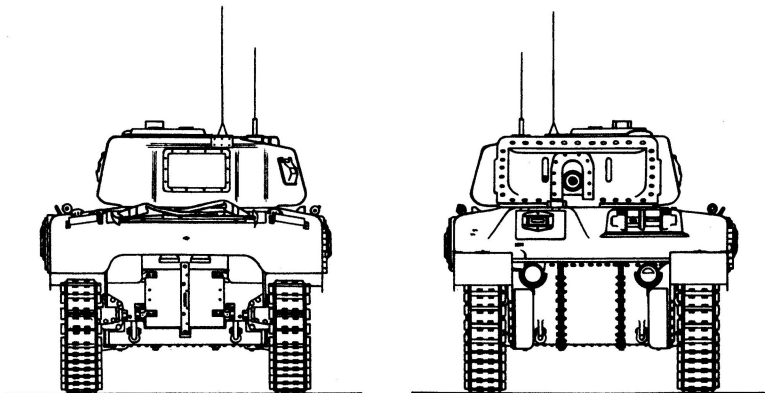
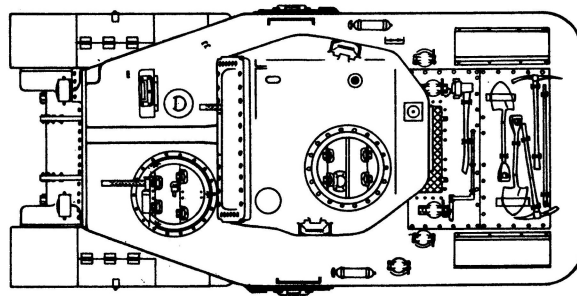
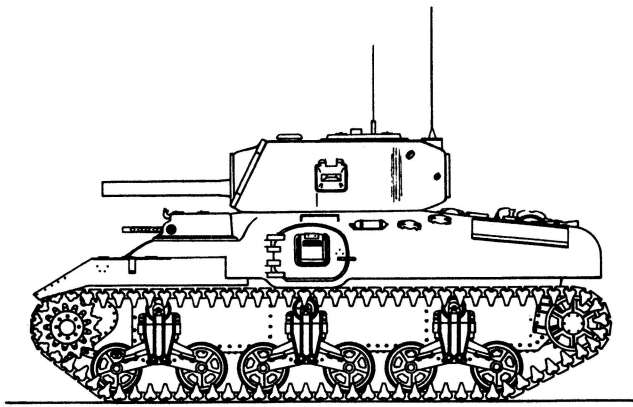
Internal Fuel capacity: 70 Imp. gals. 84 U.S. gals. 318 Litres.

Armour

Type: Rolled plate - Rivetted.

Maximum: $\frac{1}{2}$ " (12mm)

Minimum: $\frac{1}{4}$ " (6mm)



TANK CRUISER RAM II

SCALE 1:76 (4m.m. to 1foot) DRAWN BY D.P.DYER.

TANK CRUISER RAM II

Whilst utilising the basic hull, engine, suspension and transmission of the American M.3 Medium Tank, which went into production in June 1941, the Canadian built Ram also incorporated what were thought to be the best British and Canadian ideas at the time. With the main armament mounted in a 360° traverse turret and a subsidiary m.g. turret set forward next to the driver, the layout was similar to the British Cruiser Mk. IV. This involved new basic designs for the turret and upper hull, plus various minor modifications. The drawing office work was carried out at the Montreal Locomotive works, with assistance from the British and Canadian Army Staffs and experts from the General Steel Castings Company. Although the hull and turret casting design was of a major nature it was fairly straightforward. It is of interest to note that use was made of the existing turret ring of the M.3 Medium for the main turret, and the Medium M.3 Commanders cupola without vision slits for the m.g. turret.

The turret design incorporated a bolted front adaptor plate, to allow flexibility in the type or size of main gun and mounting. In order to reduce the overall height, the drivers position was moved from on top of the transmission to the floor on the right of it. Whilst all production vehicles were manufactured at the Montreal Locomotive Works, the pilot model was produced in America at the American Locomotive Works.

As an expedient to complete some vehicles in advance of the availability of the 6pdr mount and elevating gear, the first 50 tanks were fitted with 2pdr guns. These guns were shoulder controlled in elevation, and used a mounting, adapted from the Valentine Tank. Known as Ram 1 these tanks were produced in December 1941 and January 1942. During January 1942 the 6pdr armed version also started coming off the production line, the Canadians despairing of receiving British drawings of the gun mount and elevating gear, having designed their own.

The drawing shows a very early production model of the Ram II, and is alike in all respects to the Ram I other than the turret face and gun. It is of interest to compare this vehicle with the American Medium tank T. 6 (Bellona prints series eleven).

During production of the Ram II, of which 1908 were produced between January 1942 and the middle of 1943, numerous modifications were made to the design. These design changes were introduced, to keep pace with mechanical developments in the United States, and in response to user and production requirements. These included stabilisers of the gun in elevation, changing of the engine to require a lower octane rating fuel, improved ventilation, and rearrangement of ammunition stowage

Externally the first visual change was the replacement of the vision/pistol ports in the side access doors with armoured ventilators. The doors themselves were eliminated in June 1942, although the prominent ventilators were retained projecting out from the hull sides. By August 1942, these ventilators had been blended into the contours of the hull sides with openings directly above the tracks. Around the same time also the rear opening for the turret was discontinued and a turret stowage box became standard. Pistol ports were eliminated from the turret casting in September 1942.

In January 1943 a further major modification to the hull took place, whereby the front m.g. turret was replaced with a ball mounted bow m.g. position and an escape hatch was fitted to the hull floor. As far as can be ascertained, the return rollers were repositioned to the rear of each bogie assembly at the same time to allow for fitting of stronger volute springs. Production vehicles of this period also show the Canadian dry single track links with the relevant drive sprockets. These 'CDP' links were similar to the design of German track links. The British Mk. V 6pdr with a calibre length of L/52 also became standard at this period. This gun can be recognised by its long slim barrel with a cylindrical counterweight on the end and was fitted in a slightly modified turret front plate. Final production vehicles were fitted with one piece differential housings.

Although never used operationally as gun tanks the Ram did provide acknowledged incentive for the design and production of the U.S. Medium M. 4, a reserve for the defence of Britain, and training vehicles for Canadian troops both at home and in the United Kingdom. All Rams were designated Medium Tank M4A5 by the Americans for record purposes.

Rams with turrets removed were known as Kangaroos and were used as Armoured Personnel Carriers, Armoured Ammunition Carriers, and Prime Movers for towed 17pdr anti tank guns. Other Rams were modified to serve as Armoured Recovery Vehicles (A.R.V.) or Armoured Vehicles Royal Engineers (A.V.R.E.) and some were fitted with Wasp equipment and used as Flame Throwers.

Not included in the production figures quoted were 84 Tank Command/Observation Posts. These were basically Rams with dummy 6pdr guns, additional radio and observation equipment and appeared with both early and late chassis.

As an experiment one vehicle was armed with a British 75mm M. V. gun which proved most satisfactory

Technical Specification for Tank Cruiser RAM II (Jan. 1942 Production).

Crew: 5
Weight, Combat loaded: 65,000 Lbs, 29 long tons. 32.5 Short tons, 28.5 Tonnes.

Performance

Speed, Max. Road: 25 m.p.h. (40 Km.p.h.)
Max. Gradient: 35 degrees (70%)
Fording depth: 3'-4" (102cm)
Trench crossing: 7'-5" (226cm)
Step: 2'-0" (61cm)
Min. Turning circle: 31'-0" (9.5 metres)
Ground pressure: 13.1 Lbs/sq. ins (0.92 Kg/sq.cm)
Range (internal fuel) Road: 144 Miles (232 Km)
Power to weight ratio: (Net) 12.3 HP/short ton

Dimensions:

Length:	19'-0"	(564cm)
Width:	9'-5"	(287cm)
Height:	8'-9"	(267cm)
Ground clearance:	1'-5"	(43cm)
Turret ring dia:	5'-0"	(152cm)
Road Wheel dia (overall):	1'-8"	(51cm)

Trackwork

Centres:	6'-11"	(211cm)
Length on ground:	12'-3"	(373cm)
Width:	1'-4½"	(42cm)
Pitch:	6"	(15cm)
Type: Double Pin Rubber Block	Number of links per track:	79

Mechanical Details

Engine: Continental R975 - EC2 9 cylinder radial aircooled petrol 400 BHP at 2,400 r.p.m.

Transmission: Synchronesh 5F - IR

Steering: Controlled differential

Suspension: Vertical volute springs

Armament:

Main: 6 pdr QF MK III

Calibre, and length in calibres: 57mm (2.24ins.) L/45.

Traverse: 360 degrees. Operation: Hydraulic or hand turret

Elevation: plus 20 degrees, minus 7½ degrees

Secondary Armament:

1 x .30 cal m.g. co-axial

1 x .30 cal m.g. subsidiary turret

1 x .30 cal m.g. A/A

Stowage

Ammunition, main armament: 92 rds.

Ammunition, secondary armament: 4,440 rds.

Internal Fuel capacity: 146 Imp. gals. 175 U.S. gals. 663 Litres.

Armour

Type: Cast upper hull and turret riveted lower hull.

Hull, Nose upper: 2'-3" (51/76mm)

Nose lower: 2" (51mm)

Glasis plate: 2" (51mm)

Drivers plate: 2" (51mm)

Sides, upper: 2½" (63mm)

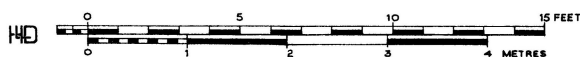
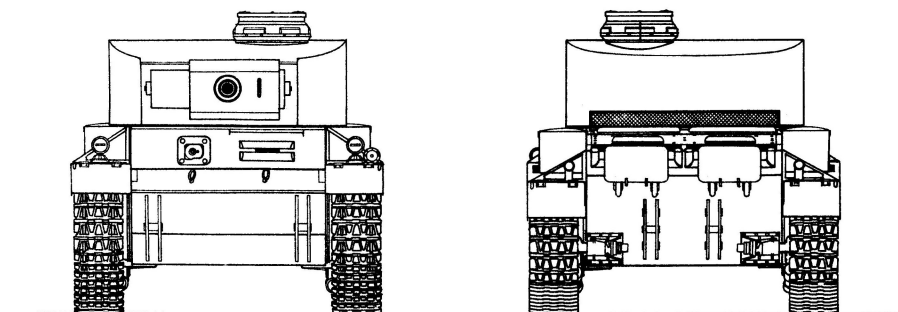
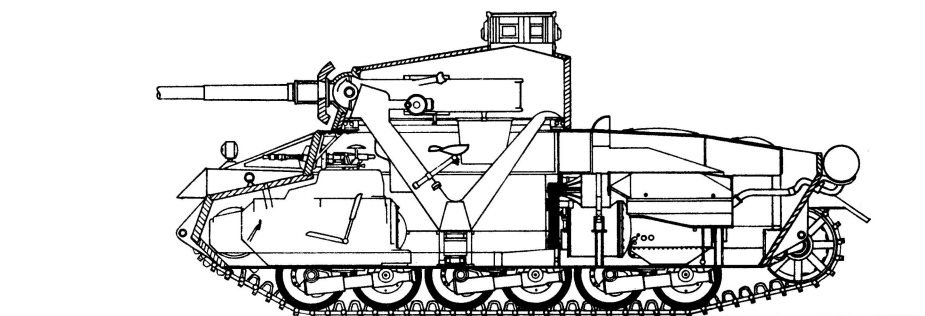
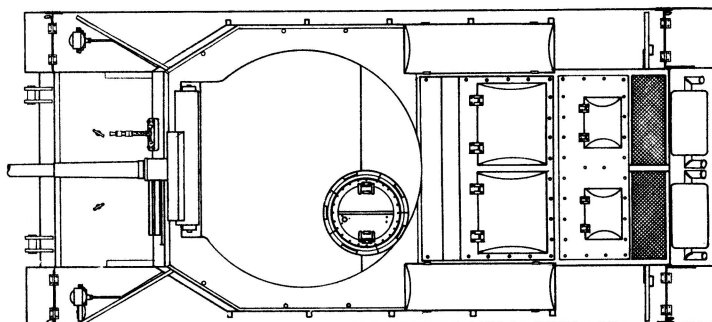
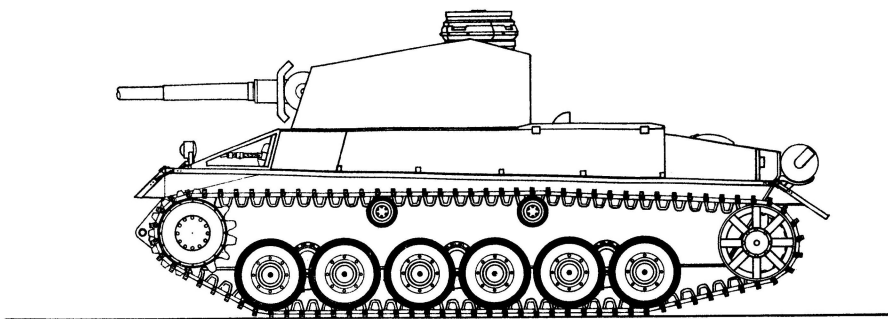
Rear, upper: 1½" (38mm)

Decking: 1'-1½" (25/38mm)

Belly, Front: 1" (25mm)

Turret: Front: 3" (76mm)

Sides: 2½"-3" (63/76mm)



VK 3001 (P) PORSCHE Typ.100 LEOPARD

SCALE 1 : 76 (4 m.m. to 1 foot) DRAWN BY H.L.DOYLE.

VK 3001 (P) - Porsche type 100 "Leopard" 1939/41.Historical research by W.J. Spielberger.

Panzerkampfwagen IV. represented Germany's first attempt to produce a modern medium battle tank. Thus it was felt that taking regard of the lessons learnt during the development of this vehicle a superior tank could be produced. As early as 1938, therefore, the Army Ordnance Department contemplated the replacement of the Panzer IV with an improved model. Thus an order for a vehicle in the 30 ton class was issued to Henschel of Kassel. A second order was issued in 1939 to the Dr. Ing.h.c.F Porsche KG. of Stuttgart.

The official Army designation allotted was VK 3001 (P). For Porsche, this vehicle was to be their first design in the field of Armoured vehicles. It received their official type number "100" and was carried in their inventory list as "special vehicle 1", but was also colloquially known as "Leopard". Production of the vehicles, designed by Porsche of Stuttgart, was supposed to take place at the Nibelungenwerk owned by the Steyr-Daimler Puch AG. in St. Valentin, Austria.

Only two prototypes were built, and even these were never fitted with turrets. However, the chassis were extensively tested during 1940 and 1941 and found satisfactory. Basic difficulties were only encountered with engines, where frequent oil leaks were most predominant. The proposed turrets to be developed, from designs suggested by Porsche, by Krupp of Essen were never completed. However, as can be seen in the drawing the striking similarity between the proposed turret of the type 100 and that later developed for the VK 4501 which became the Panzerkampfwagen 'Tiger'.

The appearance of the Russian T 34 in late Summer of 1941 brought about drastic re-evaluation in German tank design and the abandonment of designs such as that of the Type 100 which merely duplicated existing designs with insufficient advantages over them. Both Companies, Porsche and Henschel, received orders from the Ordnance Department on 26th May, 1941 to develop a 45 ton vehicle, which would be capable of mounting an 88mm gun in a fully rotating turret. This development led directly towards the design of the Panzerkampfwagen "Tiger" Series 13. No. 50/51 (GE). The VK 3001 development was discontinued at Porsche but the basic design features were utilised in the vehicle developed by Porsche to the VK 4501 (P) specifications. While the VK 4501 (P) never entered service as a battle tank 90 chassis built by Nibelungenwerk were converted to become the Panzer Jaeger "Ferdinand" or "Elefant" (Bellona Series 1. No. 4(GE). The same basic principles were again used when Porsche developed the Type 180 or VK 4502 (P) similar to the 'Tiger' Ausf B. This vehicle did not enter production either, due to lack of copper for the electric drive.

Professor Porsche, in his own way, tried to solve the problem of propelling such a heavy vehicle in a unique way which he had already attempted and successfully used in gun tractors for the Austrian Army during World War I. Two Parallel mounted power plants were coupled to individual electrical generators, which in turn provided power via electrical motors to frontal mounted final drives. The power plants in question were of new air-cooled design and were laid out as 10 cylinder units, with a 72° V arrangement of the cylinders. Each one of them had an output of 210 HP at 2500 RPM. Designed by Porsche of Stuttgart, they were built by Graz-Simmering Pauker AG. of Vienna. They were gasoline engines with a bore of 105mm, a stroke of 115mm, bringing their displacement to approximately 10 litres. Steering and speed adjustment was done electrically in connection with a "Nita" special transmission which incorporated a torque converter built by the Company of Voith in Heidenheim. Suspension was taken care of by longitudinal torsion bars which were self-contained within separate bogies. Six bogie wheels and two support rollers on each side completed the chassis.

Our drawing, based upon original project drawings, has been completed as far as is possible to show how the vehicle would have appeared had production continued. However, it is emphasised that only the two basic chassis were completed. Layout of these test vehicles can be seen in our photograph of one of the prototype vehicles undergoing trials.

Technical Specification For VK 3001 (P) Porsche Type 100.

Crew: 5

Weight, proposed: 30 ton class

Performance

Speed, Max. Road: 37 m.p.h. (60 Km.p.h.)

Fording depth: 5'-0" (152cm) Estimated

Trench crossing: (cm)

Step: 2'-7" (79cm) Estimated

Ground pressure: 12.8 Lbs/sq.ins (0.9 Kg/sq.cm)

Power to weight ratio: 13.6 Metric HP/tonne

Dimensions (Vehicle in drawing)

Length: 21'-7" (658cm)

Width: 10'-3" (380cm)

Height of chassis to Air intake 6'-7" (200cm)

Height with proposed turret 10'-0" (305cm)

Ground Clearance: 1'-7" (48cm)

Fire height of gun 7'-5" (232cm)

Turret ring dia: 6'-10½" (208cm)

Road Wheel dia (overall: 2'-4" (71cm)

Trackwork

Centres: 8'-10" (268cm)

Length on ground: 12'-3" (375cm)

Width: 1'-7½" (50cm)

Pitch: 6'-33" (16.1cm)

Number of links per track: 89

Type: Steel shoe, dry, single pin

Mechanical Details

Engine 2 x Porsche Type 100 V-10 aircooled, petrol each developing 210

HP (metric) at 2500 r.p.m. (Total 410 HP)

Transmission and Steering: Voith "Nita" electric with torque converter.

Suspension: Longitudinal torsion bars, one set per bogie of two wheels

Armament (proposed)

Main: 7.5cm KWK L/24 or 10.5cm KWK

Traverse: 360 degrees. Operation: Electric, Turret.

Elevation: plus 20.5 degrees, minus 10 degrees.

Armour (Thickness, scaled from Project Drawings)

Type: Rolled steel welded

Hull: Nose upper: 3" (75mm) at 20 degrees

Nose lower: 2.5" (62mm) at 45 degrees

Glasis plate: 2.5" (62mm) at 77.5 degrees

Drivers plate: 3" (75mm) at 15 degrees

Sides, upper: 2.5" (62mm) at 0 degrees

lower: 2.5" (62mm) at 0 degrees

Rear: 1.675" (40mm) at 31.5 + 0 degrees

Decking: 1" (26mm) at 90 degrees

Engine covers: 1" (26mm) at 87+88 degrees

Belly: 1" (26mm) at 90 degrees

Turret (proposed)

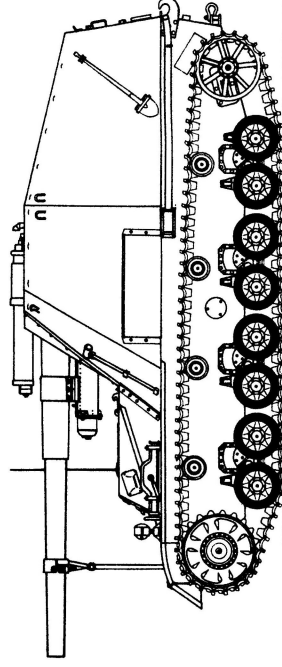
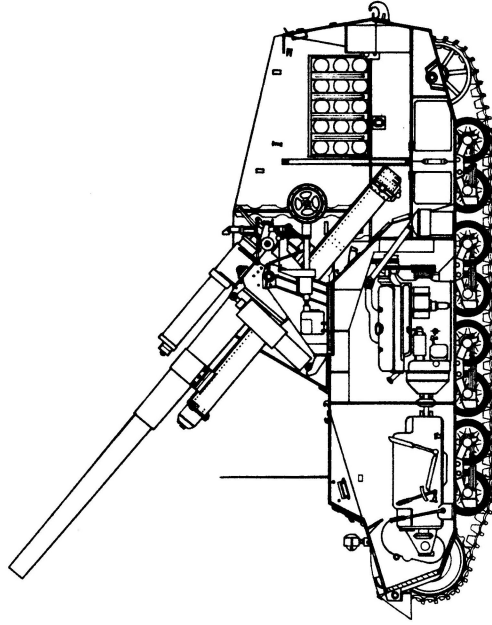
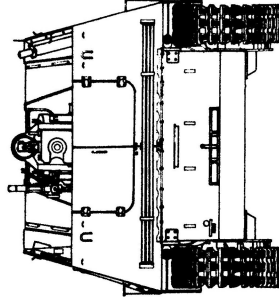
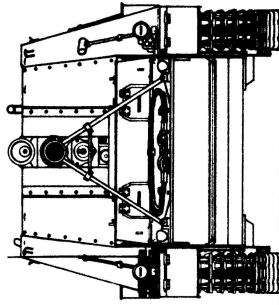
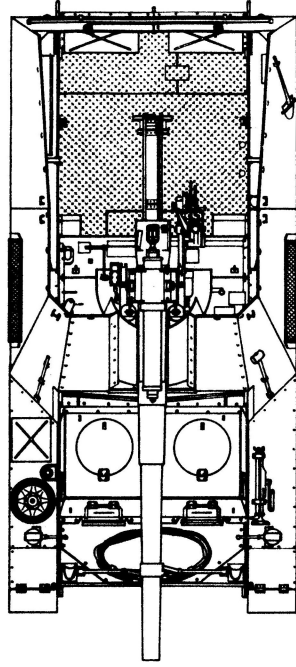
Front: 3.25" (82mm) at 21.5 degrees

Sides: 2.5" (62mm) at 0 degrees

Rear: 2.5" (62mm) at 0 degrees

Roof 1.675" (40mm) at 10+15 degrees

Mantel: 3.25" (82mm)Note: German standard angles; 0 = Horizontal. 90 = Vertical.



15 cm. schwere Panzerhaubitze 18/1 (SF) Auf GW III/IV 'Hummel'.

SCALE 1 : 76 (4 m.m. to 1 foot) DRAWN BY H.L.DOYLE.

Geschuetzwagen III/IV 'Hummel' 1942/45. Sd. Kfz. 165.

The necessity of providing Panzer Divisions, with their own mobile selfpropelled Artillery arm, was realised when the original plan for this type of formations was introduced. However, due to the industrial and War situation it was not feasible to supply the required equipment until 1942. In 1942 the establishment of German Panzer Division was modified and it was planned to eventually equip each with two Batteries of six light guns and one Battery of heavy guns, which were sufficiently mobile to keep pace with the tanks, and sufficiently powerful to defend the flanks of the Division. In addition each Panzer Corps was to have a further two heavy batteries. The equipment for the light battery was to be the 10.5cm le. FH 18/2 auf Fahrgestell Pz.Kpfw.II (Sf) 'Wespe' (Bellona Series 5 No. 20 GE). The equipment for the heavy battery was the 15cm s. FH 18/1 auf Fahrgestell Pz.Kpfw.III/IV (Sf) 'Hummel' described here.

Both the Pz.Kpfw. III and IV, while extremely efficient as battle tanks, were difficult to use as the basis for a selfpropelled mounts. To equip the armoured artillery batteries with the necessary vehicle to carry the 15cm Medium Field gun, components from both vehicles were incorporated into a new design. This was Geschuetzwagen III/IV. It utilised the suspension system from the Pz.Kpfw.IV Ausf.F. in its entirety. The final drive arrangement and drive sprockets came from the Pz.Kpfw. III Ausf. J., production. Also from the Ausf. J. came the engine and transmission. The prototype of the whole series, however, was based completely on units from the Pz.Kpfw. IV Ausf.F. To allow for a clearly arranged fighting compartment the engine was moved forward into a position formerly occupied by the turret base. The chassis of the new vehicle was designed by Alkett, but all manufacture and assembly was undertaken at the Deutsche Eisenwerke in Muelheim/Ruhr. This mount, eventually equipped with the standard 15cm s. FH 18/1 became the standard artillery unit and received the official nomenclature '15cm schwere Panzerhaubitze 18/1 (Sf) auf Fahrgestell Panzerkampfwagen III/IV' (Sd Kfz 165). The code name 'Hummel' which was originally issued, was omitted later according to Hitler's order of 27th February 1944. While the prototype appeared in late 1942, it was not until the Fall of 1943 that the Hummels began to appear in service with front line troops. Starting in the Summer of 1944 the drivers compartment was altered from the single nacelle on the left side to the full width compartment as shown in the drawing. Thus there was two distinctly different models. The GW III/IV mounting the 8.8cm PAK 43/1 so called 'Nashorn' or 'Hornisse' ceased in production about this time so it only appeared in the earlier format.

These selfpropelled guns stowed 18 rounds of ammunition and had a fighting weight of about 23 tons. The armour protection was very light, a maximum 30mm frontal hull with 20mm side while the superstructure was made up from 10mm plate. Deutsche Eisenwerke assembled a total of 666 of these units. The Armour came from Deutsche Roehrenwerke of Muelheim and Deutsche Edeltahlwerke of Hannover. In addition, there were 150 similar vehicles but without armament issued to the Heavy Batteries as ammunition carriers. These were known as 'Munitionstraeger Hummel' and differed only by having a removable plate over the front of the superstructure. Thus if necessary this could be removed and the vehicle converted to become a gun carrier.

The 15cm s. FH 18 along with the 10cm Kanone 18 formed the backbone of the German Medium Artillery. They were developed in the years between 1926 and 1930 by both Krupp and Rheinmetall. The final production model of the s. FH 18 was basically the Rheinmetall gun in a Krupp carriage. It entered service with the Wehrmacht about 1933 and 1934. As early as 1938 the Ordnance Department asked for improved models to be developed but while several new designs appeared it became impossible to change production as the main consideration was increased output of existing equipments.

A total of eight different charges were available, and these could fire the normal High explosive shell, 15cm Granate 19, which weighed 95.7 lbs. (43.5 Kgs) distances varying from 4375 yards (4000 metres) to 14550 yards (13,300 metres). The normal charges were the first six giving ranges up to 10610 yards (9700 metres) and it is interesting to note that the large charges could only be used under exceptional circumstances. In any event only ten rounds were permitted to be fired consecutively with either of these large charges, as otherwise the brakes and recuperator were liable to overstrain. From about 1942 a muzzle brake was fitted to some guns allowing more use of these charges. However, only the prototype of the Hummel was fitted with this muzzle brake. In addition to High Explosive shells of various types there were several special shells; Anti-concrete, Smoke and a Hollow Charge armour piercing shell, the 15cm Gr 39 FES-HL/A.

Normal sights were the ZE 34 (with Rbl 16, 32, 36 or 37) and a rate of fire of up to 5 rounds per minute could be achieved. The crews of the Hummels were ordinary Artillery personnel wearing the field grey uniform piped in red.

Technical Specification for GW III/IV "Hummel"

Crew: 6
Weight, Combat loaded: 51,818 Lbs. 23.13 Long tons, 25.9 Short tons 23.5 Tonnes
Performance
Speed, Max. Road: 26 m.p.h. (42 Km.p.h.). Cross country: 15 m.p.h.(24Km.p.h.)
Max. Gradient: 30 degrees (57.5%)
Fording depth: 3'-3" degrees (100cm)
Trench crossing: 7'-9" (235cm)
Step: 1'-11 $\frac{1}{2}$ " (60cm)
Ground pressure: 10.67 Lbs/sq.ins (0.85Kg/sq.cm.)
Range (Internal fuel) Road: 124 miles (200 Km) Cross country: 81 miles (130 Km)
Power to weight ratio: 12.5 Metric HP/ton

Dimensions:

Length, overall:	21'-11"	(667cm)
Length:	20'-4"	(619cm)
Width overall:	9'-7 $\frac{1}{2}$ "	(292cm)
Height:	9'-2"	(279cm)
Ground clearance:	1'-3 $\frac{3}{4}$ "	(40cm)
Fire height of gun:	7'-7 $\frac{1}{2}$ "	(232cm)
Road wheel dia (overall)	1'-6 $\frac{1}{2}$ "	46.5cm)

Trackwork

Centres:	8'-1"	(245cm)
Length on ground:	11'-6 $\frac{3}{4}$ "	(352cm)
Width:	1'-3 $\frac{3}{4}$ "	(40cm)
Pitch:	4.75"	(12cm)

Number of links per track: 101

Type: Cast steel, single pin

Mechanical Details

Engine: 1 x Maybach HL 120 TRM V-12, 11.89 litre watercooled petrol developing 300 bhp at 3000 r.p.m.

Transmission: ZF SSG 76 6 forward, 1 reverse.

Steering: Epicyclic clutch and brake. Mechanically operated.

Suspension: 4 articulated bogies on each side, sprung on quarter elliptic leaf springs.

Armament:

Main: 1 x 15cm s. FH 18/1

Calibre, and length in calibres: 150 mm (5.9ins), L/29.6.

Traverse: 3 degrees left, 3 degrees right. Operation: Hard

Elevation: plus 40 degrees, minus 3 degrees.

Secondary armament: 1 x 7.92mm. MG 34 or 42 2 x 9mm MP 38 or 40

Storage

Ammunition, main armament: 18 rds.

Internal Fuel capacity: 103.5 Imp. gals. 124.5 U.S. gals. 470 Litres.

Armour

Type: Rolled steel plate - welded and bolted.

<u>Hull</u> , Nose upper:	1.180"	(30mm)	at 70 degrees
Nose lower:	.675"	(17mm)	at 23 degrees
Glasis plate:	.395"	(10mm)	at 17 degrees
Drivers plate:	1.180"	(30mm)	at 64 degrees
Sides:	.780"	(20mm)	at 90 degrees
Rear:	.860"	(22mm)	at 80 + 25 degrees
Decking:	.595"	(15mm)	at 0 degrees
Engine covers:	.595"	(15mm)	at 0 degrees
Belly:	.595"	(15mm)	at 0 degrees

Superstructure

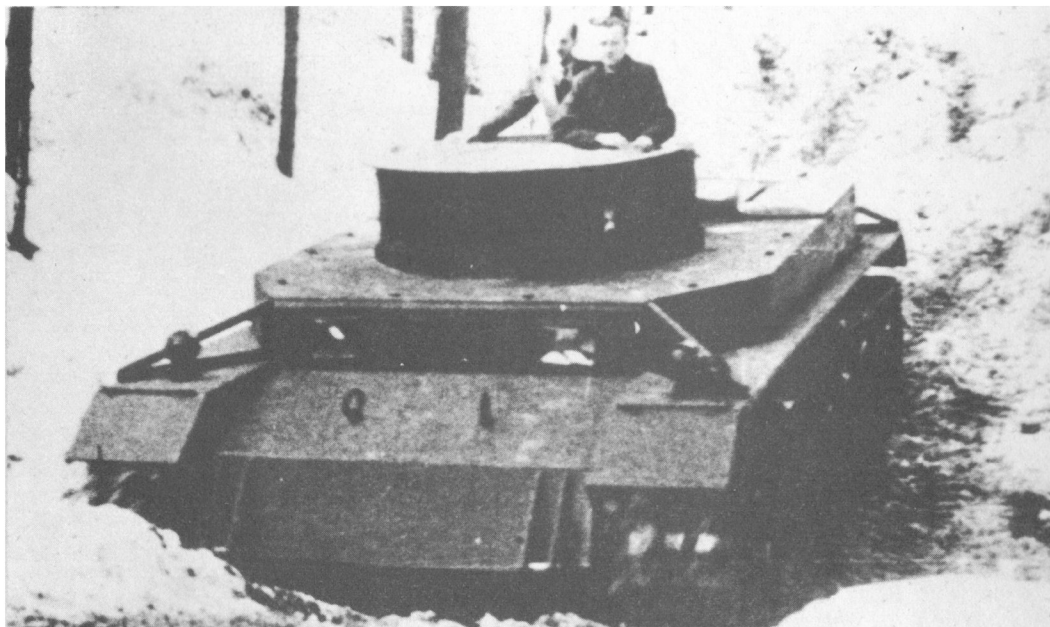
Front:	.395"	(10mm)	at 53 degrees
Sides:	.395"	(10mm)	at 74 degrees
Rear:	.395"	(10mm)	at 80 degrees
Mantel:	.395"	(10mm)	

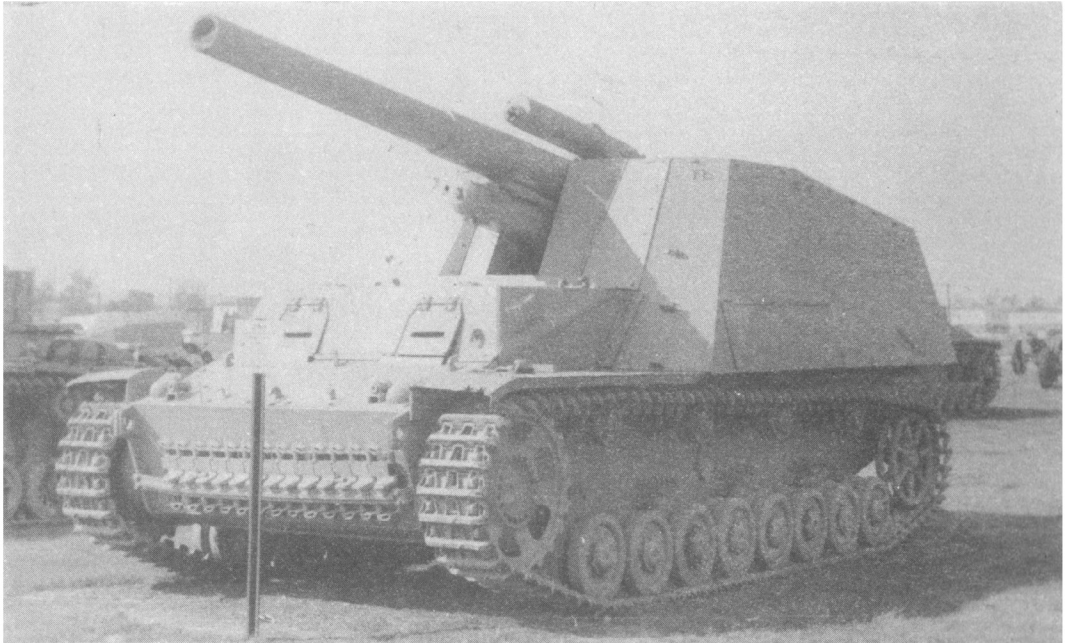
Note: German standard Angles; 0 = Horizontal; 90 = Vertical



ABOVE A Squadron of Ram Mk II Tanks lined up in review order early in 1943. These particular tanks were from the September 1942 production batch and feature many improvements over the vehicle drawn. Hull doors and turret pistol ports were eliminated altogether, while the ventilators were streamlined into the hull sides. When studying the drawing it is of interest to note that it also differed from the Mark I in minor detail. A periscope was fitted in the position where the turret ventilator is now shown and in place of the bomb thrower, the Mark I had a turret ventilator.
(Canadian Official Photo)

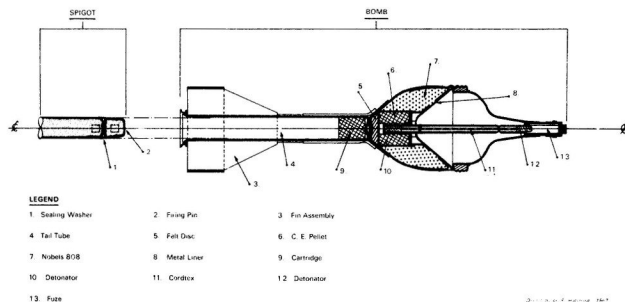
BELOW One of the VK 3001 (P) - Porsche Typ 100 'Leopard' - prototypes undergoing trials. The mock up turret fitted is only a temporary fixture simulating the full production turrets which were never completed.





ABOVE A late production GW III/IV 'Hummel' which is on display at the Aberdeen Proving Ground, Armour Museum, Maryland, U.S.A. Note the fullwidth drivers compartment which appeared in service from Summer 1944. Two further examples of Hummels are on display at the Patton Museum at Fort Knox. Additional Photographs of the various Hummel models - including the 'Munitionsträger Hummel' - are featured in the BELLONA HANDBOOK NO.1. Part I, which deals with German Selfpropelled Guns built on to German chassis.

PROJECTOR INFANTRY ANTI-TANK Mk 1.



The P.I.A.T. Mk I by B. Willis

The Projector Infantry Anti-Tank was perhaps one of the most unorthodox weapons to become a standard issue during the Second World War. It was a 'Spigot' Mortar and it was developed under the direction of a Colonel Blacker.

The bomb, details of which can be seen in the drawing, consisted of a high explosive warhead on the end of a hollow tube. This tube was in effect the barrel of the P.I.A.T. At the forward end of the tube was a propellant charge. The warhead was a shaped 'Hollow' charge of $\frac{3}{4}$ lbs (0.34 Kg.) of Nobels 808 high explosive filling. The total weight of each bomb was $2\frac{1}{2}$ lbs (1.14 Kg.)

The principle of the launcher was very simple; a spigot onto which the tail tube of the bomb slid. The spigot had at its head a firing pin. When fired, the spigot on a powerful spring shot forward striking and detonating the propellant cartridge. The explosion of the cartridge not only fired the bomb but forced back the spigot fully on the spring, thus recocking it for the next shot.

The P.I.A.T. was quite an effective weapon with a normal 'accurate' range of 100 yards (91 Metres). The charge was capable of destroying most German tanks, including the 'TIGER', if accurately fired at the side armour. The German practice of hanging sheets of thin armour 'Schurtzen' on the sides of armoured vehicles somewhat negates the potential. It was also ideal for attacking fortified buildings or pillboxes. The total weight was 32 lbs (14.5Kg) and it was somewhat awkward, the recoil was extremely heavy; these disadvantages caused it to be disliked and even feared by the infantry men.

At least one Victoria Cross was won by a man using the P.I.A.T. The weapon was eventually replaced in the British Army by the 3.5 inch (88mm) R.L. or Super Bazooka as it was called.